

SYSTEM SUPPORT DIRECTIVE

ASR-9

6310

SSM-ASR9-007

System Support Modification

ALTERNATE DUAL REDUNDANT MODIFICATION

Highlights

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June 7, 1999

1. **PURPOSE.** This System Support Modification (SSM) authorizes a modification to the Airport Surveillance Radar-9 (ASR-9) hardware to implement an alternative to the Dual Redundant Modification. The new hardware and firmware will improve reliability by offering an additional set of modems to supplement the existing modem path. The new path will provide the same data as the online surveillance processor data path.
2. **DISTRIBUTION.** This directive is distributed to selected field offices and services within Washington headquarters, regional Airway Facilities divisions, William J. Hughes Technical Center, Mike Monroney Aeronautical Center, and the Airway Facilities offices having the following facilities/equipment: ASR-9.
3. **WITHDRAWALS/CANCELLATIONS.** Not applicable.
4. **REFERENCES.**
 - a. Configuration Control Decision (CCD) N21009.
 - b. TI 6310.28, Weather Receiver/SCIP (Unit 4), Type FA-10079, Sections 1-11, Instruction Book Field Maintenance.
 - c. TI 6310.39, ASR-9 System CRF/DEPOT Maintenance, Section 8, Volume 3.
 - d. American National Standards Institute/Electronic Industries Association (ANSI/EIA-422) Standards.
 - e. TI 6130.24, ASR-9 System Instruction Book, Type FA-10064, Sections 1-11.
 - f. TI 6130.36, ASR-9 System Instruction Book, Standard Local Site Wiring Diagrams and Lists, Type FA-10064, Section 11.

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DISTRIBUTION: Selected Airway Facilities Field
and Regional Offices

INITIATED BY: AOS-270

5. **BACKGROUND.** Airport facilities, including Chicago O'Hare and Denver International, have expressed an interest in the Dual Redundant Configuration for the ASR-9. Design philosophy problems surfaced during testing for the Dual Redundant Modification. It was not possible to fix the problem in the original modification because the design specification rules were the best option at the time. This document presents some new ideas for solving problems in the original design. The technique used in this modification is optimum for maximizing the number of the surveillance channels going from the online post processor channel.

6. **APPLICATION.** This modification is applicable to all ASR-9 radar sites.

7. **MATERIALS REQUIRED.** The materials required to perform this modification will be provided in the form of a modification kit. This kit, National Stock Number (NSN) 0000-00-012-1466, consists of the following items:

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>NSN/PART NUMBER</u>	<u>QUANTITY</u>
a.	Programmable Read-Only Memory (PROM) (27S29) U90	1A24177H02	3 ea.
b.	PROM (27S29) U91	1A24178H03	3 ea.
c.	PROM (27S29) U92	1A24179H03	3 ea.
d.	Ribbon Cable W69	158C060G06	1 ea.
e.	Ribbon Cable W70	158C060G07	1 ea.
f.	Ribbon Cable W71	157C028G84	1 ea.
g.	MX6A Adapters	SP4067	3 ea.
h.	Screws – 8/32 x 1.75 inches		10 ea.

8. **SOURCE OF MATERIALS.** Materials are to be ordered through the Logistics and Inventory (LIS) system at the Federal Aviation Administration (FAA) Logistics Center. In order to prevent depletion of the material, order only the quantity required.

9. **SPECIAL TOOLS AND TEST EQUIPMENT REQUIRED.**

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>MANUFACTURER</u>	<u>PART NUMBER</u>
a.	Electrostatic Discharge (ESD) Mat		
b.	ESD Wrist Strap		
c.	Generic PROM Insertion and Extraction Tool		
d.	Cable Ties (About 12 inches long)		
e.	Dental Pick or Equivalent Small Sewing Needle to Remove Cable Connector Keying Pins		
f.	Indelible Marker Fine Point		

10. **PROCEDURE TO BE PERFORMED BY.** This modification is to be performed by field maintenance personnel or as determined by the regional Airway Facilities division manager.
11. **WHEN MODIFICATION IS TO BE PERFORMED.** This modification is to be performed as soon as possible after receipt of this modification and the required materials.
12. **ESTIMATED TIME REQUIRED.** This procedure will require 1 technician for 4 employee-hours.
13. **DISPOSITION OF SURPLUS PARTS.** Removed components remain at the sites until the site has verified no problems resulting from the modification. It will be easy to reconfigure the system at any time to go back to the original configuration if a problem develops. The modification may develop in stages where it is possible to test or verify each stage before proceeding to the next stage. The removed components shall be disposed of and not returned to the depot.

14. PROCEDURE.

NOTE: Review this entire procedure prior to beginning the modification. If this is a dual remote site, ensure that Variable Site Parameter (VSP) E102 =1.

- a. With the online transmitter high voltage ON, view the RMS ALARM REPORT menu (0.2). Verify that there are no Summary Alarms (SA) present.

NOTE: The post processors may have the interference Maintenance Alarm (MA) present. This will have no affect on the modification.

CAUTION: The Dual Redundant operation requires kit installation work in 1D17994G01 using the instructions in paragraph 14.

- b. Verify the site is running without alarms. Put weather channel unavailable prior to running Run Functional Inline Test (FIT). Run FIT on system control and the weather subsystems. Put the units back to available after test is completed.
- c. Following the procedure in TI 6310.24, section 3, part 1, volume 1, paragraph 3.3.2.5, Patch Loop Back Testing, run the patch loop back test on all surveillance links local and dual remote modems 1, 2, and 4. Do not run the patch loop back test on the weather link because it will cause an error in the system. SSM-ASR9-004, Upgraded MODE-S Interface Support, corrects this problem.
- d. Turn off the High Voltage (HV) to the online transmitter. Select internal APGs at menu 0.1.3. Locate the site spare LSCI 2 (1D18980G01) board. Open the front access door for the Weather Receiver/SCIP cabinet. Turn the Weather Receiver/SCIP cabinet power OFF. Replace the system LSCI 2 board in the A4A215 slot with the site spare. Repeat steps in paragraph 14a through 14c for the spare board.

e. Inspection.

- (1) The National Airway Systems Engineering Division, AOS-200, AOS-270 key site team discovered some ASR-9 connector keying anomalies, while working this modification. Before this modification begins, your site must be inspected for the proper cable-keying plug alignment or a connector pin may be damaged. The recommended procedure for correcting a keying plug/slot alignment problem is to move the keying plug in this kits' cable connectors with a small sewing needle or dental pick. The only way to predict the keying slot lines up with the keying plug is to inspect the cabinet connectors before the modification is initiated.
- (2) Turn off the HV to online transmitter and select APGs at the menu 0.1.5. With the cabinet power off, locate the three cables W69, W70, and W71 in the kit. For each cable connector listed in Table 1, Backplane Cable Keying Guide, verify it is keyed properly. Remove the corresponding ASR-9 cable connector, and then verify that the backplane connector keying slot position corresponds to the cable's keying plug location. Or, it may be easier to compare the position of the keying plug in the existing cable connector to the kit's cable connectors. The keying plug in these kits cable connector must be moved to the position where it aligns with the backplane connector-keying slot, regardless of the location specified in the ASR-9 documentation. Return all cable connectors to their original position when the inspection is complete.
- (3) The keying guide lists the normal position for the kits cable keying plugs and slots according to the ASR-9 documentation. The Backplane Cable Keying Guide illustrates the backplane cables even keying plug numbers line up with the cabinet connectors even keying slot numbers. The Bulkhead Keying Guide lists the normal position for the cable keying plugs and slots according to the ASR-9 documentation. When a connector is located on a cabinet bulkhead, such as the A5 assembly, the internal cables must plug into the backside of the cabinet connectors. The cabinets feed through style connectors are numbered using the opposite or front side of the connector. In this case, the even keying plug numbers line up with the odd keying slot numbers because the cable mates on the backside of the connector.

TABLE 1. BACKPLANE CABLE KEYING GUIDE

Cable	Connector	Keying Pin	Keying Slot
W69P2	A4J120	10	10
W69P3	A4J119	49	49
W70P2	A4J128	27	27
W70P3	A4J132	22	22
W71P2	A4J133	41	41
W69P1	A5J15	25	26
W70P1	A5J21	25	26
W71P1	A5J22	50	49

- (4) With the cabinet power off, for each cable connector listed in the table 1, verify it is keyed properly (refer to TI 6310.28, Figures 11-36, Weather Receiver/SCIP (Unit 4) Major Components, and 11-48, Cable Entry Chassis Assembly A5. Pin 25 is located in the middle of the J15 and J21 connector row-facing channel B (when looking up inside the Weather Receiver/SCIP cabinet connectors). Examine the bulkhead connectors plate by opening the hinged 4A2 panel on the front of the Weather Receiver/SCIP cabinet and looking up at the top of the cabinet. If the keying slot is not correct, move the keying plug in the kits cable connector to line up with the cabinet connector-keying slot. Return all cable connectors to their original position when the inspection is complete.

f. Stage 1 PROM Verification.

- (1) The goal of this first stage is to verify the PROM and to provide a path to get back to the original configuration quickly if some unforeseen problem develops. A few extra steps provide a method of isolating the master A215 LSCI2 board from the modification. This will ensure the option of returning the radar to service by placing the original unmodified board back in slot A215 at any point during the operation.
- (2) Open the front access door for the Weather Receiver/SCIP cabinet. Reference TI 6310.28, Paragraph 7.5.5.3, Local System Control Board Removal, to perform the next two steps of this modification.
- (3) Remove the site spare LSCI2 board, now in slot A4A215 and place it on a static mat. Install the new PROMs U90, U91, and U92 on this board. See TI 6310.39, Volume 4, Figure 11-87, System Control Interface 2 Board Assembly 4A4A215, for location and orientation of PROMs.

NOTE: The PROMs control the post processor channel selection criteria sequencing in the ASR-9. The PROMs are only used when the LSCI 2 is in the A215 slot. The PROMs disable the outputs to the drivers on the A217 board. Both boards contain PROMs so they will be interchangeable.

- (4) Disconnect (pull back) the LSCI2 board in slot A4A217 from the backplane, but leave it in the slot for storage. Return the modified LSCI2 spare board to the empty A4A215 slot. Place the unmodified LSCI2 board from the A215 slot in a static bag and set it aside on the static mat. Verify the removal of the board in slot A217 by observing its position where its pulled back and disconnected from the backplane. Restore power to the cabinet. If the PROMs are working, the local site modems will restore and the SCIP summary alarms A790 and A791 are not present.
- (5) Do not insert the board in the A217 slot until after the cables are changed in stage 2 of this modification. This is necessary because now both boards active outputs short together with the existing Y ribbon cables. To remove the Y ribbon cables and wire each output drive to a different cable, proceed to the stage 2 of this modification.

g. Stage 2 Cables to Modems 7, 8, and 9.

- (1) Remove power from the cabinet by following the procedure in TI 6310.28, paragraph 7.5.5.3.2, Removal and Installation Procedure, steps 1 and 2. Open the rear access panel for the Weather Receiver/SCIP cabinet. Locate the backplane A4 connector row and the bulkhead cable entry chassis A5 connectors at the top of the cabinet in unit 4. Disconnect cable plugs from their mating jacks per Table 2, Disconnect the Following Connectors. Do not remove any of the existing cables from the cabinet. Refer to TI 6310.36, Figure 11-74, Weather Receiver/SCIP (Unit 4) Schematic/Wiring Diagram, presented on the following pages to implement the cable changes.
- (2) Mark through the seven disconnected cable connector labels. Relabel these cable connectors as **not used** using the indelible markers. Wrap the disconnected cables back, keep them as far as possible to the left.

TABLE 2. DISCONNECT THE FOLLOWING CONNECTORS

Cable Connector	Backplane Connector	Top Bulkhead Connector
W62P3	A4J120	
W63P3	A4J119	
W64P3	A4J118	
W66P1		A5J22
W66P2	A4J133	
W67P3	A4J132	
W68P3	A4J128	

NOTE: Installation and routing of the cables is easier if the top bulkhead connectors are installed first.

- (3) Route Kit cables W69, W70, and W71. Find backplane and bulkhead jack per Table 3, Add the Following Connectors, and make the connection indicated on the cable markers.

TABLE 3. ADD THE FOLLOWING CONNECTORS

Cable Connector	Backplane Connector	Top Bulkhead Connector
W69P1		A5J15
W69P2	A4J120	
W69P3	A4J119	
W70P1		A5J21
W70P2	A4J128	
W70P3	A4J132	
W71P1		A5J22
W71P2	A4J133	

NOTE: Please check the orientation of the new cables follow the color code sequence of the adjacent cables in the row. Find pin 1 (it is dark brown), and pin 3 (it is red). All twisted pairs follow the standard color code sequence (brown, red, orange, yellow, green, blue, violet, gray, and white, then black starts the sequence again). Installation must maintain the color code sequence across the connector rows. Damage to keyed connector pins results if not properly aligned when they mate with the backplane shells.

- (4) The interconnection diagram (see TI 6310.36, Figure 11-74, Weather Receiver/SCIP (Unit 4) Schematic/Wiring Diagram, shows the final interconnection configuration of cables W62, W63, W64, and W66 through W71.
- (5) Tie and secure disconnected loose cable ends into existing cable runs using the tie-wraps and the longer 8/32 inch screws provided in the kit. The longer screws will elevate the plate that covers the existing cable run so the new cables will fit.
- (6) Restore power to the Weather Receiver/SCIP cabinet by following procedure TI 6310.28, paragraph 7.5.5.3, steps 7 through 11. Verify that the local site modems will restore. Verify the dual remote modems will not restore at this time because they connect to the removed LSCI2 board in slot A217. This step is important because the cable change removes the output shorts (tri-state bus) of the two LSCI2 boards. Verify by observing the racial modem front panel Light Emitting Diode (LED) Display. Press the status button on the modem to scroll the display until the LEDs show the state of the Transmit Data (TD) line. Data should not be present so the TD line will be low on the dual remote site modem lines. If this is not the case, something is wrong with the cable change. When a site does not have the dual remote modification installed, place the extended board in slot A217 to verify if output pins A217C52, A217B56, and A217A54 are open.
- (7) After verifying the outputs are open and not tied into a tri-state bus, connect (using the installation instructions in TI 6310.28, paragraph 7.5.5.3) the LSCI2 board to the backplane in the A217 slot. It does not matter if the unused PROMs U90, U91, and U92 are even on the board, modified or unmodified. Restore power to the system and verify that all modems links are operational.
- (8) If the system returns to normal operation after clearing all alarms, go to Stage 3, paragraph 7h. If the system has alarms that will not clear, remove the modification. To accomplish this, put the original cable connections back on and replace the modified site spare LSCI2 board with the original unmodified board from the static bag in slot A215. This action will return the system to its original baseline configuration.

h. Stage 3 PROM Installation and Secure Cables.

- (1) This final stage will make it difficult to return to the original configuration and it is needed to complete the modification. After testing the modified system, change the PROMs on the unmodified LSCI2 spare boards, A217, to complete the modification. The final step is to test each modified board in the Weather Receiver/SCIP A215 slot using procedure TI 6310.28, paragraph 7.5.5.3.2, for the removal and installation of the modified LSCI2 boards. Run FIT on the system control to ensure LSCI 1 and 2 boards still pass.

- (2) For reference, the system at the William J. Hughes Technical Center ran for a few months before completing the third stage of the modification without a problem. A danger exists if an unmodified LSCI2 board is placed in slot A215, the system will not work. It will not damage the hardware, but the cable changes will cause an outage until the technician removes the unmodified board.

i. MX6A Interface Option.

- (1) Three MX6A adapters in the modification kit adds new interface capability to the ASR-9 equipment. This interface allows ASR-9 surveillance data recordings, without using the modem patch panels jumpers. That is, when this modification is complete, modems 7, 8, and 9 surveillance data lines are active and may be used with the MX6A.
- (2) Locate the ribbon cables (DB37 pin connectors) on the top of the modem cabinet (under the L shaped plate) connecting the modems to the ASR-9. Disconnect the cables from the top of the modem cabinet at connectors J7, J8, and J9, corresponding to modems 7, 8, and 9. These cables may already be disconnected if the MX6A board is using the modem patch cables. If MX6A board is in use with the modem patch cables, remove them from the connectors on top of the modem cabinet (specifically J7, J8, and J9). Then connect the input side of the adapters to the disconnected cable connectors labeled (W547 P2/12J7, W547 P2/12J8, and W548 P2/12J9). Finally, disconnect the MX6A cable from the modem connectors J7, J8, and J9, then connect output side of the adapters to the cable going to the MX6A board. Channel 1 of the MX6A board should go to W547 P2/12J7 connector and adapter, channel 2 to W547 P2/12J8 connector and adapter, and channel 3 to W548 P2/12J9 connector and adapter. The MX6A adapter wiring is given below:


<u>INPUT</u>	<u>OUTPUT</u>
4	4
22	22
17	5
35	23

- 15. TEST AFTER MODIFICATION.** Supplemental testing to verify that the Clear to Send (CTS) signals from the local site modems arrive at the LSCI2 boards is recommended. The LSCI2 board test points listed below will be low (about 0 Volts (V) direct current (dc)) when the modems are operating properly. The signal will go high when the modem transmit line is interrupted. This can be accomplished by breaking the transmit line at the patch panel with one end of a patch panel jumper cable. The CTS signal at the test point will remain at a high level (about +5 V dc) until the patch panel jumper is removed and the modem returns to normal operation.

<u>MODEM UNIT A12</u>	<u>CTS SIGNAL TEST POINT IN Weather Receiver/SCIP CAB</u>
MODEM 1	4A4A215 TP51
MODEM 2	4A4A215 TP52
MODEM 4	4A4A215 TP53

- 16. RESULT OF MODIFICATION.** This modification will add two new sets of surveillance modem channels refer to the Appendix 1, Dual Redundant Wiring Diagram to Modems.
- 17. CHANGES TO INSTRUCTION BOOKS.** Two sets of page changes are attached. One set is to remain with this directive and the other set is to be inserted in the manual as instructed by the page control chart.
- 18. CHANGES TO INSTALLATION DRAWINGS.** Not Applicable.
- 19. CHANGES TO RECORDED DATA.** Prepare FAA Form 6032-1, Airway Facilities Modification Record, showing this directive number, date, chapter, and change number to change recorded data.
- 20. ADDRESS CHANGES.** Submit facility address, directive copy count, and additions or deletions via cc:Mail to Pat Conner, AOS-530.
- 21. CLARIFICATION OR COMMENTS** Not applicable.
- 22. STATUS ACCOUNTING.** Perform both the following status accounting activities:
- a. Ensure that the Quarterly NAS Equipment and SSM Status report is updated to indicate the installation of this modification.
 - b. Use the Maintenance Management System (MMS) application Log Equipment Modification (LEM) function to report the completion of this modification. Verify that an **N** is in the **REP COD** field to ensure that the log entry will be upwardly reportable to the national data base for access by AOS. This directive should be entered into the LEM fields as follows:
 - (1) Order No.: 6310
 - (2) Chapter: SMM007
 - (3) Change: HW

- 23. RECOMMENDATIONS FOR CHANGES.** Forward any recommendations for changes to this directive through normal channels to the Communications, Flight Service, Weather, and Information Resource Management Division, AOS-500.



Teresa E. Hudson
Acting, Program Director for Operational Support

6-7-99

Date

LIST OF APPENDIXES AND ATTACHMENTS

<u>Item</u>	<u>Description</u>	<u>Quantity</u>
APPENDIX 1.	DUAL REDUNDANT SIGNAL WIRING DIAGRAM TO MODEMS	1
ATTACHMENT 1.	TI 6310.28, WEATHER RECEIVER/SCIP (UNIT 4), TYPE FA-10079, SECTIONS 1-11, INSTRUCTION BOOK FIELD MAINTENANCE	1
ATTACHMENT 2.	TI 6310.39, SECTION 8, VOLUME 3, ASR-9 SYSTEM CRF/DEPOT MAINTENANCE	1